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ABSTRACT

This report reviews the findings of two projects funded by the National Institute of Education (NIE) and conducted by the American Institutes for Research (AIR). The project reports, "Going Metric" and "Metric Inservice Teacher Training," document the impact of metric conversion on the educational systems of Great Britain, New Zeland, Australia, South Africa, and Canada in order to provide educators and other planners with guides for preparing a national conversion program. Three vital needs were identified for a successful conversion policy in the U.S.: (1) a broad-scale involvement of all major elements in early planning, (2) a committed government policy and firm schedules, and (3) continued communication and coordination as conversion progresses. Recommendations include: (1) the creation of a national evaluative body that would establish clear uniform standards for metric educational materials; and (2) a coordinated teacher training strategy, with direct communication links with teachers and provisions for feedback on metric curriculum materials. (JW)

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Metric Education

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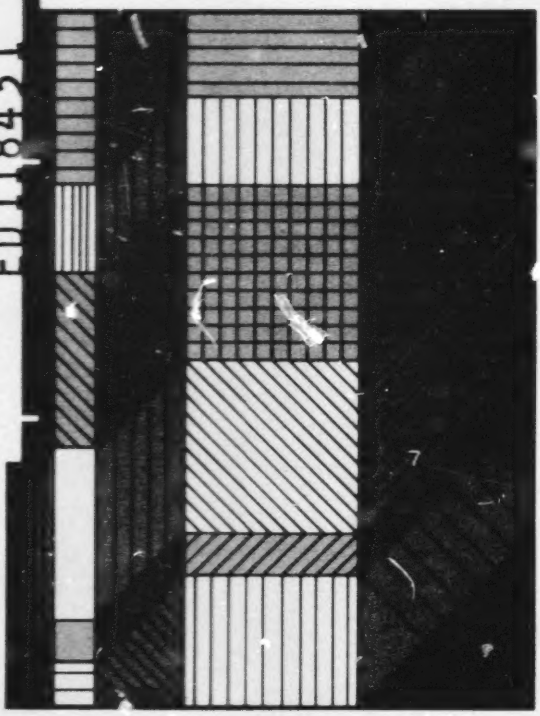

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Metric Education

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December 1975

This report was prepared by the Institute for Educational Leadership of the George Washington University, Washington, D.C. It reviews the findings of two NIE-funded projects that were conducted by the American Institutes for Research (AIR), Palo Alto, Calif. 94302. Copies of the two project reports are available from AIR and from Educational Resources Information Center (ERIC) Document Reproduction Service, P.O. Box 190, Arlington, Va. 22210.

METRIC EDUCATION

The lives and jobs of almost 90 percent of the world's population are measured in meters, grams, and the other units of the metric system. Of the major nations, only the United States continues to count and compute in yards, pounds, and gallons. The world has in effect "gone metric". It is clear that this country must ready itself for a similar commitment.

As the last "traditionalist," the United States is in a unique position to learn from the experience of those nations that have already undertaken the metric transition. Research being performed under the sponsorship of the National Institute of Education (NIE) provides educators with an opportunity to use these foreign precedents in planning for our national conversion program.

The American Institutes for Research (AIR), with support from NIE, has published two exploratory research reports documenting the impact of metric conversion on the educational systems of five countries: Great Britain, New Zealand, Australia, South Africa, and Canada. These studies, *Going Metric* and *Metric Inservice Teacher Training*, offer exclusive insights into the previously unresearched phenomena of metric conversion abroad. The AIR research team* conducted an extensive review of the metric literature and surveyed foreign educational organizations integral to the process of metric conversion. Their reports warn of pitfalls and suggest potential dividends for those who will plan America's metric education.

Historical Setting

The metric system (SI**) boasts an intriguing history. Metric units are a product of the French

*The authors of these reports are Albert B. Chalupsky, Jack J. Crawford, Edwin M. Carr, and Patrick McDonnell.

**The modern notation for the metric system, standing for "International System of Units."

Revolution and became compulsory in France by 1840. Other countries converted gradually and, at this writing, all of Europe, South America, Russia, China, Japan, and India are members of the metric community.

In the USA, metric conversion has been a highly controversial topic since colonial times. The subject has produced "more intense and virulent prose than an attack on the sanctity of motherhood," quotes *Going Metric*. In the 19th century, American zealots even compared the "atheistic metric system" to the "divinely ordained" Anglo-Saxon measurements.

Debate in recent years has been more rational, if not less heated. Congress has displayed an increasingly positive attitude toward the idea of conversion since 1972. State legislatures and boards of education have begun to design programs for the inevitable transition, while such firms as General Motors and IBM have announced their intentions to convert, regardless of government policy.

The Five Country Precedent

The United States is nonetheless poorly prepared for the transition. The first AIR report warns that there is a paucity of educational literature and almost no prior research on the dynamics of this enormous national undertaking. The authors argue persuasively that we should give increased attention to the five "living laboratories" that are currently making the change. It is imperative, they warn, that we tap this source of first-hand experience if we hope to avoid an awkward and costly switch-over.

Going Metric provides an incisive analysis of the national metric policy of the five countries. Common to all, it comments, are the roles of government, free enterprise, and public opinion as penetrating and pervasive forces setting the climate in which educators must work. These elements

affected the calibre of the metric education programs in all five nations.

Great Britain, the first of the five to begin the transition, has followed a voluntary, flexible metric conversion program since 1965. Conversion, according to *Going Metric*, was always controversial in Britain. The government ducked the issue and failed to provide strong leadership or direction. No metric legislation was passed, causing critics to charge "conversion by stealth." Coordination and communication were poor, and dissemination of information to the consumer inadequate. Although all segments of the society and economy had been expected to go metric as soon as their particular circumstances permitted, rates of conversion within the country were uneven. Schools, for example, were quick to convert. But while children studied only metric measurement in the classroom, the items they bought in the stores remained in traditional units for years. And since firm dates for conversion were not adhered to, those who followed suggested guidelines were often penalized for their enthusiasm. The *Going Metric* report states that other countries look at Britain as an example of what not to do.

New Zealand and Australia, by contrast, devised well-phased and executed programs. Both countries began the transition around 1970 and were able to benefit from Britain's mistakes. Substantial popular support for metric conversion existed before these governments committed themselves to the change. As in Britain, conversion was voluntary, to be planned by those who would be affected by it. However, both governments assumed a highly visible, pro-metric position. They organized effective coordination and communication programs and enlisted the support of private enterprise and the media.

The two Pacific governments gave high priority to developing a favorable national atmosphere for conversion. They communicated to the public the

need for metrication and an understanding of what it entailed. To accomplish these goals, "Public Awareness" campaigns, a first phase in the transition, were launched. These exploited news releases, television shows, posters, and metric "giveaways", such as calendars and rulers. Metric pamphlets were distributed to every householder in New Zealand and Australia.

The second stage, "Public Involvement," consisted of converting horse racing and weather reporting to the metric system. This had some impact in helping the population to begin "thinking metric" while avoiding major disruptions within the society.

Australia used advertising techniques that Madison Avenue might well envy. These included a well-known Olympic swimming champion who credited her success to practice in a metric pool. "Where would I be if I had to train in Australia over yards and compete in Munich over metric distances?" she asks in a government publication. The Post Office issued cartoon-like stamps depicting daily life in a metric world.

In total, the *Going Metric* report gives the impression that metric conversion in Australia and New Zealand is generally proceeding smoothly. Societal disruption has been minimal. In this positive climate, educational institutions reported little difficulty making the transition.

South Africa began conversion shortly after Britain but avoided the debilitating indecision. Here, the government took a strong, authoritative approach to metrication, and the authors called this country's effort "a model of precision scheduling." Conversion was by no means a lackadaisical affair. For example, the government issued an edict stating that it would be illegal to sell certain non-metric measuring instruments after a specific date. Violators faced fines, and/or jail sentences. Conversion was supported by free enterprise, as well as the media, and apparently proceeded

smoothly in all sectors of the society. Educators lamented only that the metric textbooks did not arrive from England on schedule!

Canada made a bipartisan policy decision to go metric in 1970 but has proceeded relatively slowly since that time. The issue is clouded by heavy dependence upon U.S. trade. The Canadian government has stated that it intends to pass no metric legislation and assumes that self-interest and economic incentive will be sufficient motivation for popular conversion. Although "think metric" programs are currently under way, actual efforts at conversion are only beginning.

Analyzing the conversion experiences of these five countries, the authors of *Going Metric* identified three vital needs for a successful conversion policy in the United States:

- Broad-scale involvement of all major elements in the early planning for metric conversion;
- Committed government policy and firm schedules; and
- Continuing communication and coordination as conversion progresses.

Implications for American Education

The experiences of the five countries studied in the NIE-supported metric reports have relevance to American education in several clearly marked sectors: teaching materials, subject areas, teacher training, teaching strategies, saving time, and expanding the role of the schools.

Teaching materials are fundamental to the process of metric conversion. According to *Going Metric*, "The early, intense demand for metric materials results in a flood of inaccurate and inadequate materials."

Initially, when schools abroad began to teach metric measurements few books were available. Teachers were forced to convert old materials and develop new ones on their own. When commercial publishing companies did make a belated contribu-

tion, many products contained incorrect abbreviations, spellings and terms, while others were educationally unsound and poorly made. In New South Wales, Australia, the Education Department reviewed all commercial materials such as conversion charts, booklets, and children's games, prior to distribution. Most were judged to be inadequate because they were either irrelevant to the learning process or encouraged users to convert from traditional to metric units—a practice recognized by all countries as an impediment to "thinking metric."

The authors believe that the U.S. can avoid this problem. They recommend the creation of a *national* evaluative body that would establish and disseminate clear, uniform standards for metric educational materials. Until this, or something like it, is done, the response to metrication will inevitably be uneven and patchy at best.

South Africa found that the size of metric units was inappropriate for young children. The gram is too small to be easily manipulated by little fingers while the kilogram is too large. "What child can drink a whole litre?" asked an English respondent. The solution lies in the use of decimal subdivisions of the system. Centimetres, for example, are quite adequate for primary school use.

Inaccurate materials were used frequently in the early stages because teachers were unaware of the availability of metric information. They tended to accept whatever was presented. The report asserts that a non-commercial, widely distributed catalogue of materials could mitigate this problem in America.

Teachers abroad did eventually learn to make their own effective metric teaching aids. The authors suggest a possible financial bonus for the USA, saying we could make "substantial time and dollar savings by conducting a specific review of these techniques and widely disseminating the results to U.S. teachers."

Subject areas affected by metric conversion, according to *Going Metric*, were not limited to those in which quantification was central. The survey found that "the impact of metric education extends well beyond science and mathematics," with other subject areas often demanding even greater attention.

Vocational education and home economics courses require extensive changes in both materials and teaching techniques. Experiments in Australia indicated that is is especially difficult for students to develop the "intuitive sense" of metric measures necessary to work in these areas. Queensland instituted a successful, cost-effective program in which students converted shop equipment as part of their learning experiences.

Social studies, according to the authors, is another area in which conversion has a substantial impact. In geography, for example, dimensions of maps must be altered. Existing statistics in most other fields will eventually have to be converted to metric equivalents. Only then will "metricated" generations of the future easily comprehend the height of our buildings in meters, the speed of our cars in kilometers per hour, or the price we pay for steak per metric pound or kilogram.

Teacher training will be affected. The *Metric Inservice Teacher Training* report emphasizes that the decentralized nature of America's educational system makes a coordinated, well-planned, teacher training strategy mandatory. Direct communication links with teachers and provision for feedback on metric curriculum materials are essential to a successful program.

The British and Australian experiences demonstrate that teacher training is most effective when "scheduled in short activity sessions, distributed over time, and alternated with classroom tryouts of materials and methods." One-time crash courses should be avoided. Respondents overseas also recommended that teacher training should include

the same activities as those presented to students. But the study on teacher training cautions that we must first plan an overall conversion strategy and avoid rushing into a "crazy patchwork of haphazardly arranged programs."

America may be able to cut metrication costs by designing training materials that meet the needs of both teachers and the general adult population. Duplicate curricula will clearly be a waste.

In parts of Australia the "traveling change agent" is an integral part of the educational system. The concept is analogous to the agricultural extension agent. During metric conversion these people visited schools in their districts, providing advice on teacher training techniques and introducing new metric curriculum items. This appears to be such an effective approach to innovation in general that the authors suggest its consideration as a permanent feature of the American educational system. The English Teachers' Centres, largely under teacher control, are presented as another model for possible adoption.

Teaching strategies will need sharp adjustment. "The choice of specific strategies for teaching the metric system can facilitate or impede 'thinking metric'," states the *Going Metric* report. Respondents unanimously disapproved of the practice of converting traditional units to metric measurements. Both children and adults became confused when they tried to relate the two systems. Attempts at translation involving conversion tables and drills were ineffective. The best learning seemed to occur when students were "immersed" in the system and when the relationship between metric units was emphasized. The process appears analogous to second language learning in which the student can speak effectively only when actually thinking in the foreign tongue. To encourage "thinking metric," most countries eliminated traditional measurements from the elementary

schools at an early date.

All age groups apparently learned most rapidly through direct "hands-on" experience with the new system. Immediate problem-solving techniques, and programmed instruction materials were recommended. Lectures and mass media programs were an effective means of presenting metric orientation and awareness information. But such abstract approaches did not help people actually learn to use the new system.

In adult education, simplicity was the favored technique. Prior to conversion, only orientation information need be provided. Of paramount importance is the reduction of anxiety and fear of the new system. This can be accomplished before conversion by publicizing the basic simplicity of the metric system and creating an awareness of the need for the transition. All countries cautioned against over-training. Teach workers only that information which they will use on the job; teach it just prior to actual use, recommended British industrial organizations. They also found that failures occurred when material was irrelevant to an employee's work. In some instances, it was necessary to instruct adults in the use of the decimal system before beginning metric training.

Since they must first unlearn the old system, adults will have a more difficult time with metrics than children. Australia encouraged school children to teach their parents. A Canadian report cited in *Going Metric* cautioned, "parents, having only recently survived the new math, will fear a new generation gap" with their children.

Metric education could mean saving time. The first AIR report notes, "Claims of major savings in instructional time are many, but research evidence is lacking." Since fractions become much less important when metric measurements are used, the class time traditionally devoted to teaching them can be saved. A British writer suggested that fractions be taken out of the elementary schools

entirely and introduced at the secondary level when abstract thinking is better developed. The U.S. Department of Commerce study quoted claims that the metric system will reduce by 25 percent the time spent on arithmetic. If this is true, it would amount to over $500 million in time saved per year. This is an argument well worth verifying through additional research.

Experience in foreign countries shows that "metrication provides an *expanded role* for schools in adult education." American schools may capitalize on this opportunity to increase their contact with the community. Parent-teacher associations, for example, may help to establish a receptive neighborhood atmosphere for metric conversion.

The two NIE-supported AIR reports are preliminary, exploratory research efforts. But they are compelling examples of what can be learned from the metric conversion experiences of other nations. Before the United States embarks upon this costly, inherently disruptive transition, more indepth attention should be given to the lessons our fellow "converts" have already learned.